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RESEARCH ARTICLE

Populations of *Agrostis diluta* Kurcz. and *Psathyrostachys caespitosa* (Sukaczev) Peschkova in Yakutia: dynamics of vitality

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Abstract

In Yakutia, natural floodplain meadows and steppes have long been involved in economic activities. To develop methods of rational use, one needs to constantly consider the state of vegetation, mainly its constituent populations. Our research focuses on studying the dynamics of the vitality of the populations of the *Agrostis diluta* Kurcz. and steppe *Psathyrostachys caespitosa* (Sukaczev) Peschkova cereals. These species play an essential role in the composition of vegetation cover. We determined the vitality coefficient IVC. Our study of populations over several years has revealed the dynamic mobility of the vital structure, which is of adaptive significance and ensures the sustainability of populations. We have found that the vital structure of the cereal populations of the meadow *Agrostis diluta* and the steppe *Psathyrostachys caespitosa* during long-term studies (2007–2013 and 2007–2016, respectively) is heterogeneous. In unfavorable humidification conditions, we characterize years as depressive. Under favorable conditions of humidification, they quickly turn into thriving plants. In addition to the weather of the vegetation periods, habitat specificity affects the vitality of species populations that differ in ecological and coenotic characteristics. The Q quality index and IVC correspond to each other by year and form a clear descending order during the transition from a thriving to a depressive state. Currently, the vital state of the populations of both species is satisfactory.

Keywords

Plant population, population dynamics, vitality, quality index

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Introduction

The issues of biodiversity conservation have recently become relevant. Russia has developed and adopted the "National strategy for the conservation of biodiversity in Russia", the primary purpose of which is to assess the state of biodiversity and develop scientific foundations for its conservation, restoration, and rational use. According to this government document, the most crucial primary conservation objects are individuals (the organismal level), populations (the population level), or the population-species hierarchy, which is the basis for the integrity and stability of natural ecosystems. Since the ecosystems in cryolithozone are characterized by increased vulnerability and slow recovery from adverse impact, the issues of maintaining and preserving plant resources are relevant. First, an adequate assessment of biodiversity is needed, particularly the study of plant populations. Knowledge of biology and the population life of species is the basis for scientific forecasting of both the further development of the population and the response of plants to adverse environmental impacts (Smirnova et al. 1976; Zhukova 1995). The aim of the paper is to study the dynamics of the vitality of bentgrass (*Agrostis diluta* Kurcz) and tussock grass populations (*Psathyrostachys caespitosa* (Sukaczev) Peschkova). These species play an active role in the composition of meadow and steppe vegetation communities, which have significant resource potential.

Bentgrass communities are widely distributed at different levels of the floodplain of the Lena River (Cherosov et al. 2010). They grow on slightly saline and saline soils. Floodplain meadows are highly productive, and, therefore, they have long been used as hay and pasture lands. Due to the increasing anthropogenic load, it is necessary to study aspects of the life of the plant population necessary for the restoration and rational use of floodplain meadows. Monitoring studies expand knowledge about species biology and the adaptive capabilities of populations in different environmental situations and assess the state of populations.

Tussock grass communities are part of the extra zonal steppe vegetation of Yakutia (Zakharova et al. 2010). The steppe communities of Yakutia are listed in the Green Book of Siberia (Koropachinsky, 1996) as relicts and the most vulnerable, under threat of degradation and destruction. In this regard, it is crucial to know the reaction of steppe plant populations to the impact of natural and anthropogenic factors and identify their vitality and adaptive capabilities over a long time. This aspect is especially true of dominant and codominant steppe communities to protect populations and entire communities. In Yakutia, the issue of preserving the vegetation cover of the steppes depends on the intensity of anthropogenic impact (the threat of grazing, trampling, and natural recreation), which is aggravated by frequent droughts.

Therefore, monitoring studies of plant communities and their constituent populations is necessary to develop methods for the conservation, restoration, and rational use of meadows and steppes. For example, due to long-term studies of Central Asian meadows on the indicator of the average number of species, several scenarios

have been proposed for predicting changes in its biodiversity depending on various socioeconomic and climatic conditions (Nunez et al. 2020).

We suggested that by 2100, grassland biodiversity will decrease due to the intensification of anthropogenic pressure and climate under any scenario.

The most sensitive and highly informative indicator of changes in habitat conditions is the vital state of individuals. We analyze individual morphometric parameters to assess the overall state of the plant and population. Furthermore, the size structure of populations is often based on only a few morphometric characteristics, such as the number of rosettes, several leaves, size, and plant biomass. (Doust 1981; Shaukat et al. 2012; Vöge 2014). The vital structure of populations is based on a set of biomorphological characteristics (Kovalenko et al. 2019; Zlobin 1989).

Material and methods

The authors have researched the floodplain meadows and steppes of the Middle Lena valley in Yakutia. The article analyzes the long-term monitoring material of two populations of two types of cereals.

Bentgrass (*Agrostis diluta* Kurcz.) is a valuable feed cereal, a boreal circumpolar species. According to the database "International Plant Names Index", *Agrostis diluta* is a synonym of *Agrostis stolonifera* L., a widespread species in Europe, Asia, North Africa, and North America. *Agrostis diluta* is singled out and described in Kurchenko (2002) as an independent species from *Agrostis stolonifera* based on differences in life form, duration of ontogenesis, and morphological features of vegetative and reproductive organs. The independence of the species *Agrostis diluta* is recognized by the leading Russian taxonomists of the Poaceae family Barn. (Probatova 2006; Tsvelev 2011). The species occupies a transitional position between the stolon-forming *Agrostis stolonifera* and the long-rooted *Agrostis gigantea* (Kurchenko 2002; Probatova 2006; Tsvelev 2011). According to N. N. Tsvelev (2011), *Agrostis diluta* is closer to the *Agrostis gigantea* group than to the *Agrostis stolonifera* group by the presence of well-developed tufts of hairs on the callus of the lower flower scales. *Agrostis diluta* is one of the dominant species of plant communities in floodplain meadows (Cherosov et al. 2010).

Tussock grass (*Psathyrostachys caespitosa* (Sukacz.) Peschkova) is a valuable feedstock, a perennial grain from the Eurasia steppe. In Yakutia, it is found in semi-desert and actual steppes on the steep left bank slopes of the Lena River. According to the ecological and floristic classification of Braun-Blanquet, the communities of the species are assigned to the class *Cleistogenetea squarrosae*, the order *Stipetalia krylovii*, the union *Psathyrostachion caespitosa* with one association (agrium) *Psathyrostachetum caespitosa* (Gogoleva 1999).

The authors create geobotanical descriptions of plant communities using generally accepted methods. The dominant species distinguish plant agriums, and the projection coverage of species is given as a percentage. The ecological assessment

of the species' population habitats is based on processing geobotanical descriptions using regional ecological scales (Troeva et al. 2010). The authors use data from the Yakut hydrometeorological service to characterize weather conditions. Based on data on the average daily temperature and the amount of precipitation, the indicator of providing the territory with moisture – the hydrothermal coefficient (HTC) – is the ratio of the amount of precipitation to the specified amount of temperatures above 10 °C for the same period (Selyaninov 1937; Zoidze and Khomyakova 2006). HTC is calculated for the period of passage of the phenophase "spring germination-vegetation-flowering-fruiting" in May-July.

Populations are studied using generally accepted population-ontogenetic methods (Harper 1977; Rabotnov 1950; Smirnova et al. 1976; Zhukova 1995; Zlobin 2009). Morphological analysis of generative shoots of 30 generative plants is carried out in each population. A total of 27–29 measurements and calculations have been made. They include (1) the height of the shoot, (2) the length of all internodes, (3) the number of leaves, (4) the length of the sheaths, (5) the length and width of the leaf blades of all leaves of the shoot, (6) the length of the inflorescence, (7) the number of nodes in the inflorescence, (8) the number of flowers and grains in the inflorescence. Additionally, for *A. diluta*, the number of branches in the inflorescence and the maximum branch length.

Based on the analysis of morphological characteristics of individuals, the vital structure (level of vitality) of the population is determined by the method of Yu. A. Zlobin (Zhilyaev 2011; Zlobin 1989). For assessing the vitality of populations, the authors use the vitality index IVC, calculated from the size spectra of the component populations of individuals of generative ontogenetic state (Ishbirdin et al. 2005):

$$IVC = \frac{\sum_{t=1} Xi / \overline{Xi}}{N},$$

where X_i is the average value of the i-th trait of the population. $\overline{X_i}$ is the average value of the i-th trait for the entire populations. N is the number of traits. The highest value of IVC corresponds to the best conditions for implementing growth potentials, the lowest value corresponds to the worst conditions.

The assessment of an individual's vitality is calculated based on the average values of all plant traits for the entire sample of individuals. According to IVC values, individuals are divided into three classes of vitality: "A" is high, "B" is medium, and "C" is low. Vitality classes are established by the proportional division of the interval x ±1.96 σ (Ishbirdin et al. 2005).

The assessment of the vitality of the population is performed using the quality criterion Q (Zlobin, 2009): Q=1⁄2 (a+b), if Q>C is a thriving type, Q<C is depressive, and Q=C is equilibrium.

Results

Studies of *Agrostis diluta* populations were carried out between 2007 and 2013 in two different associations of mixed herbs-bentgrasses of floodplain meadows. These areas were flooded annually by short-term floods, except for 2008 and 2012, when longer spring floods were observed. Population 1 (P1) is located at the low ridge site in the mixed-herbs-bentgrass association (A1). Throughout the years of study, A1 has been dense with a general projective cover (60% to 100%). The composition of the species in different years has varied from 12 to 33 species. The dominant is *Agrostis dilute* with a projective cover of 30% to 70%. The co-dominants are *Festuca rubra* L., *Poa pratensis* L., and *Plantago media* L. The site is characterized by good moisture (the moisture level is 67.7–72.2), relatively rich soils (the richness and salinity level are 10.9–11.5), and weak grazing (the percentage of pasture is 3.4–3.7).

Population 2 is located in the middle floodplain hollow in the mixed herb-bentgrass association 2 (A2), where floodwater accumulates and stagnates. A2 is used as pasture. The status of pasture digression varies between 3.4 and 3.9. The community is characterized by a higher moisture content than A1 (the moisture status is 7.4 to 75.8) and the richness and salinity status (11.5 to 12.8). It has dense herbage (PP=60-100%) with a projective cover of *Agrostis diluta* of 20% to 80% and a more flawed species composition (10–17 species). Co-dominance of *Agrostis diluta* in different years, *Hordeum brevisubulatum* (Trin.) Link, *Plantago media* L., and *Glaux maritima* L.

Populations of *Psathyrostachys caespitosa* have been studied in associations with the formation of psathyrostachys. Population 3 (P3) is located in the Khangalassky District on a steep slope (45 °) without trees of a stepped structure due to microsolifluction in the *Ephedra monosperma* + *Artemisia frigida* + *Saphyrostachys caespitosa* association (A3) that occupies a large area. Population 4 (P4) is located 155 km north of P3 in the Namsky district. It is located at the top of a short slope of 30 ° steepness, without a step structure in the association *Festuca lenensis* + *Carex duriuscula* + *Pasathyrostachys caespitosa* (A4). It occupies a small area. The middle and lower part of the slope is occupied by larch forest. The slope exposure is the same, South-East.

The total projected grass cover in different years varies in A3 from 20% to 30% and in A4 from 45% to 65%. However, the uncompressed and highly rare grass cover of the steep slope of A3 is not inferior in the number of species to the denser herbage of A4. In general, psathyrostachys associations are characterized by exceptional poverty of species composition and nonclosed grass cover. The floral composition of the associations in the research years (2007–2016) decreased from 14–17 to eight species. Moreover, there are relict (*Stipa krylovii* Roshev.) and those listed in the "Red Book of Sakha Republic (Yakutia)" of (*Gagea pauciflora* Turcz. ex Ledeb.) kinds (Danilova 2017). The abundance of *Ephedra monosperma* C. A. Mey, *Artemisia frigida* Willd relics has decreased. Common co-dominants include four types: *Festuca lenensis* Drob., *Carex diriuscula* C. A. Mey., *Artemisia commutata* Bess. and

Potentilla bifurca L. There are associations of psathyrostachys in close proximity. The rare species listed in the "Red Book of Sakha Republic (Yakutia)": *Kraschenin-nikovia lenensis* (Tzvel.) Kumin., *Gagea pauciflora* Turcz. Ex Ledeb., and *Elytrigia villosa* (Drob.) Tzvel (Danilova 2017).

Therefore, according to regional scale indications, communities with *Agrostis diluta* are confined to habitats with moist meadows and relatively rich soils with weak grazing. P2 differs from P1 in the highest moisture content and degree of trampling. The habitats of *Psathyrostachys caespitosa* are included in the range of reasonably rich soils. The degree of moisture is located on the gradient of dry-arc soil moisture. On the pasture digression scale with a score of 4.1 to 4.3, they experience a weak influence of grazing. However, populations differ by type of anthropogenic factor. If the area with P3 is subject to grazing (more horses) in the absence of recreational load, then the area with P4, on the contrary, in the absence of grazing, is periodically trampled, being a place of recreation for the population, especially in the early summer period.

The dynamics of the vital state of two natural populations of *Agrostis diluta* have been studied for seven years considering the entire set of parameters of morphological characteristics of individuals (counting units of populations, a total of 27 characteristics). In 2007–2008, population 1 (P1) had a significantly high level of individuals of the middle (B=56.7%–80.0%) of vitality class (Table 1), and the share of individuals of the higher class (A) was 3.3% and 20.0%. In 2007, the share of individuals of the lower (C) class was 30.0%, and in 2008 they were missing. The vitality index (IVC=0.927 and 1.049) and the Q criterion (10.5 and 15.0) were high, determining the state of P1 as thriving. In 2009, the majority (86.7%) of the individuals were included in the higher class of the vitality group, the rest in the middle-class group. Lower-class individuals were absent. This year, the maximum values of IVC and Q are observed (1.306 and 15.0, respectively). In 2007–2009, the population was described as thriving. In 2010–2011, the share of class A individuals sharply decreased to 6.7%–23.3%, and the share of class C individuals increased to 20.0%–60.0%. In 2011, P1 transformed from a thriving type to a depressive type with a low IVC value (0.868). In 2012, the population observed an increase in the proportion of the highest (up to 36.7%) and middle (up to 53.3%) classes. As a result, their necessary condition improved. In 2013, the state of the population deteriorated (IVC=0.863). The proportion of class B individuals increased (50.0%) and class C amounted to 46.7%. Thus, P1 again transformed into a depressive state.

In the first year of the study, P2 flourished and consisted mainly of class B individuals (70.0%), with high Q (14.0) and IVC (1.054) values. In 2008, the state of the population deteriorated to a depressive type: the proportion of individuals of the middle vitality class decreased (56.7%) and the proportion of individuals of the lower class increased (40.0%). In 2009, the highest Q and IVC values were observed since most of P2 was composed of individuals with high morphological characteristics (class A=66.7%). Individuals from the lower class were absent. Therefore, P2 became a thriving type. In 2010, a uniform distribution of individuals in three

vitality classes characterized the population as an equilibrium. We recorded a decrease in Q and IVC indicators due to an increase in the proportion of middle- and lower-class individuals in 2011 and 2013. During these years, the depressive type of population persisted.

We considered changes in the state of populations on the ecocline established by the vitality coefficient. A decrease in the IVC value shows several deteriorations of the plant growth conditions. In P1 *Agrostis diluta* on the gradient of deterioration of the weather arranged a number: 2009 (ECO=1.306) – 2010 (1.061) – 2008 (1.049) – 2007 (0.927) – 2011 (0.868) – 2013 (0.863). In P1 for the deterioration of the vital state, the following series was: 2009 (ECO=1.213) – 2007 (1.054) – 2010 (0.980) – 2008 (0.917) – 2013 (0.868) – 2011 (0.849).

Table 1. Characteristics of coenopopulations of the vital structure of *Agrostis diluta* coenopopulations

№	Year of study	Percentage of individuals of vitality classes, in %			Q	IVC	Population type by the vitality
		A	B	C			
P1	2007	3.3	66.7	30.0	10.5	0.927	Thriving
	2008	20.0	80.0	0	15.0	1.049	Thriving
	2009	86.7	13.3	0	15.0	1.306	Thriving
	2010	23.3	56.7	20.0	12.0	1.040	Thriving
	2011	6.7	33.3	60.0	6.0	0.868	Depressive
	2012	36.7	53.3	10.0	13.5	1.061	Thriving
	2013	3.3	50.0	46.7	8.0	0.863	Depressive
P2	2007	23.3	70.0	6.7	14.0	1.054	Thriving
	2008	3.3	56.7	40.0	9.0	0.917	Depressive
	2009	66.7	33.3	0	15.0	1.213	Thriving
	2010	30.0	36.7	33.3	10.0	0.980	Equilibrium
	2011	0	43.3	56.7	6.5	0.849	Depressive
	2013	3.3	43.3	53.3	7.0	0.868	Depressive

The dynamics of the vital state of two natural populations of the steppe grass *Psathyrostachys caespitosa* were studied for six to eleven years by considering the complete set of vegetative and generative parameters (29 in total) of the morphological structure of individuals. We present the results of the *Psathyrostachys caespitosa* populations vital state survey for two indicators in Table 2. In P3, where observations were made during 2007–2012, the differentiation dynamics into three vitality classes are as follows. A high proportion (40%) of individuals of the highest vitality class (A) was observed for only one year – in 2008 (Table 2). In the remaining years, it decreased sharply from 40% to zero. Share in the years of observations, the aver-

age number of developed individuals (class B) varied more – from 6.7% to 83.3%, with peaks in 2007–2008.

Individuals of the lower vitality class (C) with low parameters were at least 3.3% in 2008. In subsequent years, the proportion of lower-class individuals increased sharply from 50.0% to 93.3%. We reflect the change in the distribution of individuals of different vitality classes by year in the quality index indicators. In 2007–2008, the Q index reached its maximum values and P3 was rated as thriving by vitality type. During 2009–2012 Q indicators decreased by two, three, or more times. In addition, the population became depressed.

Table 2. Characteristics of the vital structure of *Psathyrostachys caespitosa* populations

№	Year of study	Percentage of individuals of vitality classes, in %			Q	IVC	Population type by the vitality
		A	B	C			
P3	2007	0.0	83.3	16.7	12.5	0.989	Thriving
	2008	40.0	56.7	3.3	14.5	1.185	Thriving
	2009	0.0	30.0	70.0	4.5	0.876	Depressive
	2010	6.7	43.3	50.0	7.5	0.926	Depressive
	2012	0.0	6.7	93.3	1.0	0.767	Depressive
P4	2007	63.3	33.3	3.4	14.5	1.256	Thriving
	2008	30.0	70.0	0.0	15.0	1.132	Thriving
	2009	13.3	63.3	23.3	11.5	1.039	Thriving
	2011	50.0	46.7	3.3	14.5	1.183	Thriving
	2012	6.7	56.6	36.7	9.5	0.957	Depressive
	2013	0.0	15.4	84.6	2.0	0.783	Depressive
	2016	0.0	17.2	82.2	2.5	0.780	Depressive

P4 conducted longer-term monitoring of changes in vital structure from 2007 to 2016. The distribution of individuals by vitality classes in P4, as in P3, varied in wide ranges. The high density of the upper and middle classes of vitality and the correspondingly high-quality index remained longer throughout 2007–2011. During this period, the P4 vitality type was thriving. In 2012–2016, most individuals became depressed, increasing the proportion of individuals with low vitality (class C). This aspect caused the quality index to decrease from 2.0 to 9.5 and the population to change to a depressive type. In P3, the habitat degradation gradient ranked *Psathyrostachys caespitosa* as follows: 2008 (IVC=1.185), 2007 (0.989), 2010 (0.926), 2009 (0.876), and 2012 (0.767). In P4, the descending IVC ecoline by year was presented in the following order: 2007 (IVC=1.256), 2011 (1.183), 2008 (1.132), 2009 (1.039), 2012 (0.959), 2013 (0.783), and 2016 (0.780).

Discussion

The population vitality coefficient (IVC) is an important characteristic. The method of assessing the vitality of a population proved that the maximum development of plants is obtained in the most favorable conditions that determine the possibility of realizing their potential. Therefore, the order of the IVC coefficient from the minimum to the maximum value is a series (gradient) of improvement of ecological and coenotic plant growth conditions (ecocline). In the current case, the gradient of worsening growth conditions (or increasing stress) can be arranged as a series of years in descending order of the value of the vitality coefficient.

The most favorable conditions for the development of individuals with *Agrostis diluta* are formed in the growing periods of 2007–2009 with insufficient water availability (HTC (hydrothermal coefficient) = 0.97, 0.8, and 0.97, respectively). After several favorable vegetation periods, the dry 2010 year does not significantly affect the state of the populations. However, the continuation of the drought in 2011–2012 (HTC=0.55-0.63) adversely affected the vitality of populations. Furthermore, increased water availability (HTC=1.42) in 2013 harmed the condition of the populations.

Weather conditions affected *Agrostis diluta* populations due to spring flooding. Thus, in adverse weather conditions (dry years), a more prolonged spring flood favors the vitality of populations, while in favorable years, it does not. Long-term studies of floodplain ecosystems in European countries also confirm that the main factors in the normal functioning of floodplain meadows are floods (Asdonk et al. 2019; Entwistle et al. 2019; Suchara 2018). Therefore, due to anthropogenic modification of rivers, natural floodplain ecosystems have been disrupted: landscapes have changed, biodiversity has decreased, and ecosystem dynamics have been disrupted.

Comparison of the Q and by-year indicators reveals their clear correspondence and the same order of decreasing during the transition to a depressive state. It characterized depressive populations by low Q (six to nine) and IVC (0.863–0.917). The Q indicators of the equilibrium populations are 10.0 and IVC is 0.980. High Q (10.5–15) and IVC (0.927-1.306) indicators characterize thriving populations.

A comparative analysis of the vital composition of populations based on the average values of the number of individuals of the vital classes shows that 47.2%–51.0% are individuals with average indicators of morphostructure characteristics (class B). The remaining are distributed in classes A (21.1% to 25.2%) and C (23.8% to 31.7%). The IVC indicators of both populations do not differ significantly in the same years, showing similar ecological and coenotic habitat conditions.

Researchers agree that steppe plant species are most sensitive to changes in ecological and cenotic conditions and the level of anthropogenic impact on habitats. Therefore, they comprise the subject of study in different regions of the country and abroad (Abramova and Mustafina 2017; Kashin et al. 2017; Selyutina et al. 2017).

A comparison of the average values of the vital structure of the *Psathyrostachys caespitosa* populations studied for all years demonstrates that the proportion of

individuals of the middle and lower vitality classes is approximately equal (44.0% and 46.7%, respectively). However, the highest-class individuals have averaged only 9.3% during the study years. Another example is in P4, where half of the individuals (52.2%) belong to the middle class, and the representation of the individuals of the higher vitality class (28.1%) is rather significant. Comparing the IVC indicators of two populations in the same years also demonstrates a better vital state of P4 compared to P3.

It can be explained because they differ in the specifics of habitat conditions under similar coenotic conditions in both populations of *Psathyrostachys caespitosa* (lack of competition from other species). P3 grows in more extreme habitat conditions – on a steeper (45°) treeless steep slope of solifluction origin with sparse herbage. The environmental factors that determine the state of P3 are higher insolation (severe overheating) and a significant lack of moisture due to surface runoff of snow and rainwater on a steep slope with a low projective cover of grass. Furthermore, the anthropogenic impact (grazing) is slightly higher in P3, as *Psathyrostachys caespitosa* is characterized by early spring regrowth, and narrow-leaf associations, including A3, are more actively used as pasture in the spring and early summer season (May and early June). In addition, one cannot ignore the crumbling of the steps when grazing.

During the entire monitoring period, both populations do not have a uniform distribution of *Psathyrostachys caespitosa* individuals in the three vitality classes – the equilibrium type. However, a comparison of Q and IVC indicators by year reveals their clear correspondence and the same descending order when they transform into a depressive state.

According to the quality index Q and IVC, the most favorable vegetation conditions for *Psathyrostachys caespitosa* were observed in 2007–2008 and the worst – in 2012 and 2016. Weather data have confirmed that aspect. The weather conditions in 2012 and 2016 were characterized as exceptionally dry, with the minimum hydrothermal moisture coefficient for all years of observation (HTC=0.54–0.55). In contrast, in 2007-2008, the HTC was 0.83–0.97. On the other hand, there was significant precipitation and such conditions were characterized as arid (insufficient water availability). In years when the IVC score is higher than one, in our case in the range of 0.989 to 1.256, both populations flourish, with scores below one corresponding to a depressed state.

Therefore, the dynamism of the the vital structure of populations of the steppe grass *Psathyrostachys caespitosa* is primarily affected by the level of water availability. The assessment of the vital structure of *Psathyrostachys caespitosa* populations demonstrated that the highest level of vitality was provided by the conditions observed in 2008 and 2009 when both populations were in a state of prosperity according to two indexes – the quality index Q and IVC. On the contrary, in dry years, the vitality of plants decreased and both thriving populations changed into a depressive state.

Conclusion

Long-term population monitoring of the cereals of meadow *Agrostis diluta* and steppe *Psathyrostachys caespitosa* has revealed that the primary response to environmental factors is a change in the indicators of the population of individuals morphostructures - the vital state of individuals and the population as a whole. The leading factor that affects the level of vitality under mild/moderate anthropogenic impact is the availability of water for plants during the growing season. In addition, the vital state of the populations of both sod types of grass, which differ sharply in ecological and coenotic characteristics, depends on orographic factors that determine the specificity of the habitats.

During several years of research, the vital structure of the populations' meadow cereal *Agrostis diluta* and steppe *Psathyrostachys caespitosa* is heterogeneous. The conditions of the studied populations are characterized as depressive in unfavorable humidification conditions, and, however, in conditions of favorable humidification, they quickly turn into a thriving type. These adaptive advantages contribute to the existence of *Agrostis diluta* and *Psathyrostachys caespitosa* as the dominant species of floodplain meadows and steppes, respectively.

Currently, the vital state of the populations of both species is satisfactory. However, under conditions of intensification of anthropogenic pressure, as the primary factor in changing the habitat conditions of the meadow and steppe communities, more monitoring of the species populations is necessary.

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